

Appl. No. 09/560,715
Amdt. dated August 31, 2004
Response to Notice of Allowance July 29, 2004

PATENT

Amendment to the Claims:

This listing of claims will replace all prior versions, and listings of claims in the application:

Listing of Claims:

1. (Previously presented) A mass spectrometer probe comprising a substrate having a surface and a hydrogel material on the surface, wherein the hydrogel material comprises a water-insoluble and water-swellaable polymer, having absorbed at least 10 times its own weight of a liquid, that is crosslinked and is at least about 10 microns thick and further comprises binding functionalities for binding with an analyte detectable by the mass spectrometer.
2. (Original) The probe of claim 1 wherein the substrate is in the form of a strip or a plate.
3. (Previously presented) The probe of claim 1 wherein the substrate comprises an electrically conducting material.
4. (Original) The probe of claim 1 wherein the surface of the substrate is conditioned to adhere the hydrogel material.
5. (Canceled)
6. (Original) The probe of claim 1 wherein the surface of the substrate is rough, porous or microporous.
7. (Canceled)
8. (Previously presented) The probe of claim 1 wherein the hydrogel material is in situ polymerized on a glass surface by depositing a solution comprising monomers onto the glass surface and wherein the monomers are pre-functionalized to provide binding functionalities.

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9.-10. (Canceled)

11. (Original) The probe of claim 1 wherein the hydrogel material is in the form of a discontinuous pattern.

12. (Canceled)

13. (Original) The probe of claim 1 wherein the hydrogel material is continuous and has one or two-dimensional gradient of one or more of the binding functionalities.

14. (Original) The probe of claim 1 wherein a plurality of different hydrogel materials comprising different binding functionalities are on the surface of the substrate.

15. (Original) The probe of claim 1 wherein the hydrogel material is a homopolymer, a copolymer, or a blended polymer.

16. (Original) The probe of claim 1 wherein the hydrogel material is derived from substituted acrylamide monomers, substituted acrylate monomers, or derivatives thereof.

17. (Original) The probe of claim 1 wherein the binding functionalities attract the analyte by salt-promoted interactions, hydrophilic interactions, eletrostatic interactions, coordinate interactions, covalent interactions, enzyme site interactions, reversible covalent interactions, nonreversible covalent interactions, glycoprotein interactions, biospecific interactions, or combinations thereof.

18. (Original) The probe of claim 1 wherein the binding functionalities of the hydrogel material are selected from the group consisting of a carboxyl group, a sulfonate group, a phosphate group, an ammonium group, a hydrophilic group, a hydrophobic group, a reactive group, a metal chelating group, a thioether group, a biotin group, a boronate group, a dye group, a cholesterol group, and derivatives thereof.

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19. (Previously presented) The probe of claim 18 wherein the binding functionalities comprise a carboxyl group and the hydrogel material is derived from monomers selected from the group consisting of (meth)acrylic acid, 2-carboxyethyl acrylate, N-acryloyl-aminohexanoic acid, N-carboxymethylacrylamide, 2-acrylamidoglycolic acid, and derivatives thereof.

20. (Previously presented) The probe of claim 18 wherein the binding functionalities comprise a sulfonate group and the hydrogel material is derived from acrylamidomethyl-propane sulfonic acid monomers or derivatives thereof.

21. (Previously presented) The probe of claim 18 wherein the binding functionalities comprise a phosphate group and the hydrogel material is derived from N-phosphoethyl acrylamide monomers or derivatives thereof.

22. (Previously presented) The probe of claim 18 wherein the binding functionalities comprise an ammonium group and the hydrogel material is derived from monomers selected from the group consisting of trimethylaminoethyl methacrylate, diethylaminoethyl methacrylate, diethylaminoethyl acrylamide, diethylaminoethyl methacrylamide, diethylaminopropyl methacrylamide, aminopropyl acrylamide, 3-(methacryloylamino)propyltrimethylammonium chloride, 2-aminoethyl methacrylate, N-(3-aminopropyl)methacrylamide, 2-(t-butylamino)ethyl methacrylate, 2-(N, N-dimethylamino)ethyl (meth)acrylate, N-(2-(N, N-dimethylamino))ethyl (meth)acrylamide, N-(3-(N, N-dimethylamino))propyl methacrylamide, 2-(meth)acryloyloxyethyltrimethylammonium chloride, 3-methacryloyloxy-2-hydroxypropyltrimethylammonium chloride, (2-acryloyloxyethyl)(4-benzoylbenzyl)dimethylammonium bromide, 2-vinylpyridine, 4-vinylpyridine, vinylimidazole, and derivatives thereof.

23. (Previously presented) The probe of claim 18 wherein the binding functionalities comprise a hydrophilic group and the hydrogel material is derived from monomers selected from the group consisting of N-

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(meth)acryloyltris(hydroxymethyl)methylamine, hydroxyethyl acrylamide, hydroxypropyl methacrylamide, N-acrylamido-1-deoxysorbitol, hydroxyethyl(meth)acrylate, hydroxypropylacrylate, hydroxyphenylmethacrylate, polyethylene glycol monomethacrylate, polyethylene glycol dimethacrylate, acrylamide, glycerol mono(meth)acrylate, 2-hydroxypropyl acrylate, 4-hydroxybutyl methacrylate, 2-methacryloxyethyl glucoside, poly(ethyleneglycol) monomethyl ether monomethacrylate, vinyl 4-hydroxybutyl ether, and derivatives thereof.

24. (Previously presented) The probe of claim 18 wherein the binding functionalities comprise a hydrophobic group and the hydrogel material is derived from monomers selected from the group consisting of N, N-dimethyl acrylamide, N, N-diethyl (meth)acrylamide, N-methyl methacrylamide, N-ethyl methacrylamide, N-propyl acrylamide, N-butyl acrylamide, N-octyl (meth)acrylamide, N-dodecyl methacrylamide, N-octadecyl acrylamide, propyl (meth)acrylate, decyl (meth)acrylate, stearyl (meth)acrylate, octyl-triphenylmethylacrylamide, butyl-triphenylmethylacrylamide, octadecyl-triphenylmethylacrylamide, phenyl-triphenylmethylacrylamide, benzyl-triphenylmethylacrylamide, and derivatives thereof.

25. (Previously presented) The probe of claim 18 wherein the binding functionalities comprise a metal chelating group and the hydrogel material is derived from monomers selected from the group consisting of N-(3-N, N-biscarboxymethylamino)propyl methacrylamide, 5-methacrylamido-2-(N, N-biscarboxymethylamino)pentanoic acid, N-(acrylamidoethyl)ethylenediamine N, N', N'-triacetic acid, and derivatives thereof.

26. (Previously presented) The probe of claim 18 wherein the binding functionalities comprise a reactive group and the hydrogel material is derived from monomers selected from the group consisting of glycidyl acrylate, acryloyl chloride, glycidyl(meth)acrylate, (meth)acryloyl chloride, N-acryloxysuccinimide, vinyl azlactone, acrylamidopropyl pyridyl disulfide, N-(acrylamidopropyl)maleimide, acrylamidodeoxy sorbitol activated with bis-epoxirane compounds, allylchloroformate, (meth)acrylic anhydride, acrolein, allylsuccinic anhydride, citraconic anhydride, allyl glycidyl ether, and derivatives thereof.

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27. (Previously presented) The probe of claim 18 wherein the binding functionalities comprise a thioether group and the hydrogel material is derived from thiophilic monomers selected from the group consisting of 2-hydroxy-3-mercaptopyridylpropyl (methacrylate), 2-(2-(3-(meth)acryloxyethoxy)ethanesulfonyl)ethylsulfanyl ethanol, and derivatives thereof.

28. (Previously presented) The probe of claim 18 wherein the binding functionalities comprise a biotin group and the hydrogel material is derived from biotin monomers selected from the group consisting of N-biotinyl-3-(meth)acrylamidopropylamine and derivatives thereof.

29. (Previously presented) The probe of claim 18 wherein the binding functionalities comprise a boronate group and the hydrogel material is derived from boronate monomers selected from the group consisting of N-(m-dihydroxyboryl)phenyl (meth)acrylamide and derivatives thereof.

30. (Previously presented) The probe of claim 18 wherein the binding functionalities comprise a dye group and the hydrogel material is derived from dye monomers selected from the group consisting of N-(N'-dye coupled aminopropyl) (meth)acrylamide and derivatives thereof.

31. (Previously presented) The probe of claim 18 wherein the binding functionalities comprise a cholesterol group and the hydrogel material is derived from cholesterol monomers selected from the group consisting of N-cholesteryl-3-(meth)acrylamidopropylamine and derivatives thereof.

32.-75 (Canceled)

76. (Previously presented) The probe of claim 1 wherein the binding functionality is a reactive group selected from the group consisting of an epoxide and a carbonyldiimidazole.

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77. (Canceled)

78. (Previously presented) The probe of claim 1 wherein the hydrogel material comprises cellulose or dextran.

79. (Previously presented) The probe of claim 1 wherein the surface is substantially smooth.

80. (Canceled)

81. (Previously presented) The probe of claim 1 wherein the substrate comprises an insulating material.

82. (Previously presented) The probe of claim-1 wherein the surface of the substrate is conditioned with a coupling agent and the hydrogel material adheres to the surface through a covalent interaction with the coupling agent.

83. (Previously presented) The probe of claim 1 wherein the hydrogel is attached to the surface in a plurality of discontinuous spots.

84. (Previously presented) The probe of claim 82 wherein the coupling agent is a silane-based agent.

85. (Previously presented) The probe of claim 82 wherein the hydrogel is attached to the surface in a plurality of discontinuous spots.

86.-93. (Canceled)

94. (Previously presented) The probe of claim 1 wherein the hydrogel material is derived from 3-(methacryloylamino)propyltrimethylammonium chloride monomers.

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95. (Previously presented) The probe of claim 1 wherein the hydrogel material is derived from 2-acrylamidoglycolic acid monomers.

96. (Previously presented) The probe of claim 1 wherein the hydrogel material is derived from N-(acrylamidoethyl)ethylenediamine N, N', N'-triacetic acid monomers.

97. (Previously presented) The probe of claim 18 wherein the surface of the substrate is conditioned with a silane-based coupling agent and the hydrogel material adheres to the surface through a covalent interaction with the coupling agent.

98. (Currently Amended) The probe of ~~claim 1~~ any of claims 1-4, 6, 8, 11, 13-31, 76, 78, 79, 81-85, and 94-97 wherein the substrate comprises a metal having a thickness of at least 0.5 mm.

99. (Previously presented) The probe of claim 98 wherein the substrate comprises a silicon oxide coating thereon.

100. (Previously presented) The probe of claim 98 wherein the hydrogel material is in situ polymerized on the surface of the substrate.

101. (Canceled)

102. (Previously presented) The probe of claim 100 wherein the substrate comprises a silicon oxide coating thereon.

103. (Canceled)